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(54) ISDN-based system for making a video call

ISDN-basiertes Bildfernsprechsystem
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(73) Proprietor: **AT&T Corp.**
New York, NY 10013-2412 (US)

(72) Inventors:
• **Dagdeviren, Nuri Ruhi**
Red Bank, New Jersey 07701 (US)
• **Mohammadi, Khashayer**
Middletown, New Jersey 07748 (US)
• **Papanicolaou, Andreas Constantine**
Lincroft, New Jersey 07738 (US)

(74) Representative:
Buckley, Christopher Simon Thirsk et al
Lucent Technologies (UK) Ltd,
5 Mornington Road
Woodford Green, Essex IG8 0TU (GB)

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Description

[0001] This invention relates to methods and systems for converting a voice grade audio call to an ISDN audio and video call, and to apparatus for use in an ISDN video phone for converting a voice grade audio call to an ISDN multimedia call.

[0002] The emergence of video phones in the marketplace, coupled with the adoption and increasing implementation of Narrowband Integrated Services Digital Network (N-ISDN) standards, has brought to the attention of network and video telephony designers certain practical communications compatibility issues associated with the integration and co-existence of N-ISDN video telephony with "standard" telephony, also called Plain Old Telephone Service (POTS). As is well known, one N-ISDN standard is the Basic Rate Interface (BRI), which defines operating parameters for the transmission and reception of mixed medium digital information over a digital subscriber loop. For the basic rate interface, the loop is logically partitioned into two bearer (B) channels and one data (D) channel, commonly known as a 2B + D interface.

[0003] One of the major N-ISDN/POTS compatibility issues relates to the diverse types of calls that a caller using a multi-media terminal device can initiate to a called party whose subscriber loop characteristics and terminal device media support capabilities are unknown. For example, when a caller using an ISDN-compliant video phone wants to communicate with a called party whose access line arrangement and terminal device media support capabilities are unknown, the caller typically initiates an audio call using one of the BRI bearer channels as a voice grade communication path, since the caller is unable to ascertain whether the called party has a POTS line connected to an analog telephone set or an ISDN BRI subscriber loop connected to an ISDN-compliant video phone. In an ISDN environment, an audio call is initiated by an end-user device, such as a video phone requesting speech bearer service from the network. Similarly, a clear data call is established by an end user device, such as a video phone requesting unrestricted 64 Kbps bearer service from the network. The initiation of a voice grade call also stems from the caller's awareness that a clear data call to the called party will not be completed if the called party does not have an ISDN BRI subscriber loop.

[0004] If, in the course of their conversation, calling and called parties find out that they are both using the audio capabilities of ISDN-compliant video phones, it is likely that they might wish to switch to a multi-media (audio/video) call instead of the single medium (audio only) call. In that case, it would be desirable for the call to be transitioned gracefully from an audio only call to an audio and video call, without any loss of audio communication between the parties while the video call is being set up.

[0005] The ISDN standards developers anticipated

this compatibility issue and accordingly, drafted CCITT Q.931 fallback negotiation standards specifications, also called "bearer capability selection standards", as a network-based solution to that problem. These standards include provisions for a call setup message to carry signaling information specifying, for example, a preferred medium and an alternate medium for a call. Thus, in an ISDN Q.931 fallback negotiation standard compliant networking environment, a video phone caller initiating a call to a party whose terminal capabilities are unknown would request an end-to-end clear data channel (for a video/audio call) as the preferred communication path, with an option for "fallback" to a voice grade channel as a communication path of last resort. The latter option is exercised when either the communication network connecting calling and called parties is unable to provide a clear end-to-end data channel connection, or the called party has a non-ISDN telephone set connected to a POTS line.

[0006] Since the Q.931 fallback negotiation standards involve appropriate circuit selection and other decisions by the originating, intermediate and terminating switches, these standards must be implemented in all of the switches within the communication path of a call in order to allow a communication network to reserve an application and medium independent transport mechanism for a clear data channel call. In that case, the terminal adapters or the terminal devices negotiate the speed, protocols, medium or application for the call. However, due to the high implementation costs associated with the Q.931 fallback negotiation standards, communications carriers have been reluctant to implement these standards in the switches deployed in their networks. With no clear sign on the horizon pointing to a speedy and widespread implementation of these standards, an alternate solution for gracefully transitioning a voice grade audio call to an ISDN audio and video call is needed.

[0007] Another attempt to provide a graceful transition from a one-medium call to a multimedia call involves the use of the premises-based H.221 ISDN standard, which includes specifications for dynamic reconfiguration of bandwidth allocation for different media within one ISDN bearer channel. More specifically, the H.221 ISDN standard offers capabilities to handle speed negotiation for each medium and handshake communications protocols between terminal devices before an end-to-end connection is transitioned from a one-medium call to a multimedia call. The H.221 standard offers an adequate solution for ISDN calls originating and terminating on video phones connected to the same ISDN switch, since the switch does not have to make a facilities selection decision to complete the call. Unfortunately, one of the limitations of the H.221 standard is that it represents a viable solution only for calls either purposely initiated over clear data channels or for calls that happen to use clear data connections by virtue of the fact that the originating and terminating video phones are connected to

the same ISDN switch. Thus, a graceful transition from a one-medium call to a multi-media call is still an unresolved problem in a mixed ISDN and POTS communication network.

[0008] COMMUTATION ET TRANSMISSION, vol. 13, no. 3, 1 January 1991, pages 5-14; EUDE G. et al discloses a videophone system that has the calling party initiating a call in a video mode using a first channel. If the called party does not have a videophone, a second call is made indicating the call is an audio call. When the called party has a videophone, the calling party initiates a second call using a second channel. The initial first channel and the second channel are then used to complete the transmission of video and audio data.

[0009] According to one aspect of this invention there is provided a method as claimed in claim 1.

[0010] According to another aspect of this invention there is provided a system as claimed in claim 6.

[0011] According to a further aspect of this invention there is provided apparatus as claimed in claim 11.

[0012] An ISDN audio and video call is made between two video phones a) by first completing an initial audio call carried over a communication path consisting of one of the logical channels of the digital loop of each video phone and the voice grade trunks interconnecting the switches serving those video phones, b) by gracefully transitioning from the initial audio call to an ISDN audio and video call using a different logical channel for each video phone and clear data trunks connecting the switches, and c) by tearing down the initial audio call after the transition has been completed. During the transition, the communication path for the initial audio call is maintained while the separate clear data connection for the ISDN audio and video call is being established.

[0013] The separate clear data connection is set up between the two video phones through exchange of handshake communication protocol signals and synchronization parameters between the video phones. After audio signals are transmitted by each video phone to the other via the clear data connection, the audio communication from the initial communication path is switched to the clear data connection. Then, the initial communication path is torn down.

[0014] In a preferred embodiment of the invention, while the initial audio call is maintained active, the ISDN audio and video call is initiated by a first video phone directing its serving switch to establish a clear data connection to a second video phone. Directions to the serving switch are contained in call setup messages transmitted via the signaling channel of the digital loop along with the telephone number associated with the second video phone. The call setup message is routed to the second video phone via the signaling network of the communication switching system connecting the two video phones. The second video phone returns a "connect" message to the first video phone to indicate that an end-to-end clear data connection is reserved for the ISI(N) audio and video call. Upon receiving the connect

message, the first video phone generates and inserts framing control signals, such as H.221 frame alignment bits, in the available bearer channel and transmits those signals to the second video phone via the reserved clear data connection. The second video phone detects the framing control signals and returns a code to the first video phone to indicate that synchronization between the two video phones has been achieved. The two video phones negotiate bandwidth allocation for audio and

10 video signals and then are ready to transmit to each other digital bit streams that make up the audio and video call via the reserved clear data connection. Upon reception by each video phone of the digital bit streams transmitted by the other video phone, the audio communication signals carried over the initial communication path are switched by the video phones from the initial communication path to the clear data connection. Then, the communication path that carried the initial audio call via the voice grade facilities is torn down by one of the video phones.

15 [0015] If the ISDN video phones have enhanced video capabilities, (meaning that they can use two bearer channels for ISDN audio and video calls) the audio and video call can be further transitioned gracefully from a 20 one-bearer channel video call to a two-bearer channel call. Taking advantage of well-known prior art techniques, such as H.221 ISDN standards, the bearer channel freed by the termination of the voice grade call is reused as the second channel for the enhanced video call.

Brief Description of the Drawing

[0016] In the drawing:

35 FIG. 1 is a block diagram of a communication switching system arranged to route ISDN audio and video communication traffic over clear data facilities and POTS audio communication traffic over voice grade facilities;

40 FIG. 2 is a block diagram of a controller for an ISDN video phone embodying the principles of this invention;

45 FIG. 3 shows a graphical representation of signals and call processing messages transmitted by ISDN video phones and different components of a communication switching system to allow a clear data channel to be established between the devices while a voice grade channel is still active; and

50 FIG. 4 presents, in flow diagram format, actions taken and decisions formulated by the ISDN video phones and different components of a communication switching system to implement this invention.

Detailed Description

[0017] FIG. 1 is a block diagram of a communication switching system arranged to route ISDN multimedia

communications traffic over clear data facilities and single medium POTS audio communication traffic over voice grade facilities. Shown in FIG. 1 are two types of end user devices, namely a) analog devices, such as telephone sets 101, 105, 121 and 125 which receive and transmit analog voice traffic over voice grade facilities, and b) ISDN compliant devices, such as video phones 103, 107, 123 and 127 which can receive and transmit digitized voice and video traffic over clear data facilities. ISDN video phones are currently available from various sources, such as OKI, Mitsubishi Electronics and NEC. Those video phones can be used with appropriate modifications (described below) to implement our invention. Video phones 103, 107, 123 and 127 transmit and receive audio, video and supervisory signals over subscriber digital loops 104, 108, 124 and 128 respectively, each of which complies with the ISDN Basic Rate Interface (BRI) standards. Digital loops 104, 108, 124 and 128 are connected to central office switches 110 and 120 which are processor-controlled, software-driven communication switching systems arranged to switch POTS and ISDN traffic and to establish clear data communication paths for calls initiated by ISDN devices such as video phones 103, 107, 123 and 127. Central office switches 110 and 120 may be implemented using the AT&T No. 5ESS® switch, whose features and functionality are described in AT&T Technical Journal, Vol. 64, No. 6, part 2, pp. 1305-1564, July/August, 1985.

[0018] Central office switches 110 and 120 select facilities to route calls destined for devices connected to other central office switches. The type of facilities selected by central office switches 110 and 120 is predicated on the type of calls initiated by the caller and the type of access arrangement serving the device being used by the caller. For example, voice grade calls initiated by ISDN or non-ISDN devices are automatically routed over voice grade trunks 111 or 118 to interexchange carrier 180 by central office switches 110 and 120, respectively. Similarly, central office switches 110 and 120 route clear data calls initiated by ISDN devices over clear data trunks 112 and 119, respectively. Voice grade trunk group 116 is arranged to carry primarily voice traffic and as such, may be equipped with permanent echo cancelers placed at strategic points on that trunk group to compensate for echo impairment in the audio signals transmitted via channels in the trunk group. Clear data trunk group 117, by contrast, may not have any echo cancelers or may be equipped with controllable echo cancelers. It is to be understood that a call initiated by video phone 123, for example, and destined for video phone 127, which is connected to the same switch, can be gracefully transitioned from an audio only call to an audio and video call using the techniques of the prior art, since each central office, such as central office 120, is arranged to route all calls between end user devices connected to the same switch over clear data channels. The same principle would be true for calls initiated from video phone 103, destined for video phone

107 and routed by central office switch 110.

[0019] Voice grade trunk groups 111 and 118 and clear data trunk groups 112 and 119 connect central office switches 110 and 120 to toll switches 131 and 141 (respectively) which are themselves interconnected within interexchange carrier network 180 by trunk groups 116 and 117. Interexchange carrier network 180 is a communication switching system which is comprised of toll switches, such as toll switch 131 and 141, transmission facilities, such as trunk group 116 and 117 and a signaling network, such as signaling network 151, and which is arranged to route long distance calls to central office switches, such as central office switches 110 and 120. Toll switches 131 and 141 are programmable communication switching systems that operate as points of access and egress for all traffic to be switched on interexchange carrier network 180. Toll switches 131 or 141 may be implemented using the AT&T No. 4ESS® whose architecture and capabilities are explained in great detail in Bell System Technical Journal (BSTJ), Vol. 56, No. 7, pp. 1015-1320, September, 1977.

[0020] Toll switches 131 and 141 exchange call handling messages via signaling network 151, which is a packet switching network comprised of a plurality of interconnected nodes called Signal Transfer Points (STPs), which exchange call processing messages according to a specific protocol, such as CCITT common channel interoffice signaling number 7, called "SS7" for short. The protocol used by signaling network 151 for call

processing messages is different from the Q.931 protocol used for ISDN call processing messages. Accordingly, switches 110 and 120 map Q.931 messages into SS7 messages before forwarding them to signaling network 151. Similarly, switches 110 and 120 map SS7 messages received from signaling network 151 into ISDN Q.931 messages before transmitting them to video phones 103, 107, 123 and 127. Signaling network 151 is also connected to STPs 113 and 133 serving central office switches 110 and 120 respectively. The interconnection of an interexchange carrier signaling network with an STP serving a central office switch is sometimes called "Common Channel Signaling Network Interconnect" (CCS-NI).

[0021] FIG. 2 is a block diagram of an ISDN video phone arranged to switch audio signals from a voice grade channel to a clear data channel after synchronization with another ISDN video phone has been achieved. In FIG. 2, audio signals for the established voice grade call are transmitted and received over voice grade bearer (B) connection 201, which is one of the logical channels within subscriber loop 104, 108, 128 or 124 of FIG. 1. The received signals are converted into a digital Pulse Code Modulation (PCM) bit stream in codec 202 and forwarded via line 220 to matrix switch 203.

The latter is arranged to connect either line 220 or 240 to converter 204 upon receiving appropriate instructions from call processing unit 213 (described below). Incoming digital signals from line 220 or 240 are transformed

into analog electrical audio signals by converter 204 and forwarded by the latter to ear phone 205.

[0022] Call processing unit 213 is a processor, which executes programming instructions stored in Electrically Erasable Programmable Read Only Memory (EEPROM) 215, including the instructions described in FIG. 4. In addition, EEPROM 215 stores the last number dialed on the video phone and the number for the last call received by the video phone. Illustratively, the activation of video button 251 to initiate a video call causes a signal to be sent to call processing unit 213 via line 252. That signal triggers the retrieval of either the last dialed number or the last received number depending on whether the video phone of FIG. 2 is operated by the party who initiated the voice grade call or the party who received the voice grade call. Call processing unit 213 generates a call setup message that is transmitted along with the last dialed number or the last received number to the serving central office switch via D (signaling) channel 235 of the basic rate interface. Signaling channel 235 is one of the logical channels within subscriber loop 104, 108, 128 or 124 of FIG. 1. A connect message is returned to call processing unit 213 via the same channel. From that point on, all handshake protocol signals (H.221 signaling information described below) exchanged between the two video phones are transmitted and received via subchannel 233 of bearer channel 230, which is one of the logical channels within subscriber loop 104, 108, 128 or 124 of FIG. 1. When call processing unit 213 receives a call setup message and a calling party number from another video phone and determines that a voice grade call from the same source is still in progress on the other bearer channel of the digital loop, call processing unit 213 suppresses ringing for that call and automatically answers the call by sending a "connect" message to the video phone initiating the audio and video call. Call processing unit 213 receives synchronization and control signals from the other video phone and generates acknowledgement and other supervisory signals to initiate synchronization with the other video phone to indicate, for example, when handshake has been achieved with the other video phone. In addition, call processing unit 213 supervises and controls the operations of matrix switch 203 and audio codec 207. When handshake with the other video phone has been achieved, call processing unit 213 sends a signal to audio codec 207 indicating that the latter should start a) coding the audio signals received from mouthpiece 208 and transmitting those signals to interface unit 250, b) decoding audio signals received from interface unit 250 via link 231, and c) sending audio signals to matrix switch 203 over link 240. When call processing unit 213 receives a signal via H.221 signaling subchannel 233, indicating that the other video phone is also sending audio signals over the clear data connection, call processing unit 213 sends a signal to matrix switch 203 (via signaling bus 241) to disconnect line 220 and to connect line 240 to converter 204. Thus, call process-

ing unit 213 controls the graceful transition of a call from a single medium (audio only) call to a multimedia (audio and video) call.

[0023] Call processing unit 213, audio codec 207 and video codec 211 receive their input from and transmit their output (via interface unit 250) to clear data channel 230. The latter is subdivided into three subchannels or virtual circuits, namely, subchannel or virtual circuit 231 for reception and transmission of audio signals, 10 subchannel 232 for video signals and subchannel 233 for synchronization and control signals (H.221). It is to be understood that subchannels 231, 232 and 233 are not physical lines but rather logical data streams multiplexed over the physical communication path of the 15 bearer channel of the basic rate interface using, for example, the CCITT H.221 recommendations for multiplexing scheme. The audio signals are forwarded to audio codec 207 for decoding and conversion into a digital stream which is sent by matrix switch 203 to converter 204 only upon instructions of call processing unit 213, as mentioned above. Similarly, audio codec 207 converts signals received from mouthpiece 208 (through converter 209) into digital bit streams that are transmitted in compressed format to the other video phone via 20 subchannel 231 of the bearer channel 230. The output of mouthpiece 208 is also sent to PCM codec 202 which plays a similar role as codec 207 but uses different well known digital encoding techniques.

[0024] Interface unit 250 demultiplexes audio, video and H.221 synchronization signals received over B channel 230 and multiplexes a) video signals sent in compressed format by camera 206 (via video codec 211), b) audio signals also in compressed format by mouthpiece 208 (via audio codec 207), and c) synchronization (and control) signals by call processing unit 213 for transmission over B channel 230. Interface unit 250 can be implemented using a time slot interchanger and ISDN-BRI compliant physical line interface units.

[0025] FIG. 3 shows a graphical representation of signals and call processing messages transmitted by ISDN video phones and different components of a communication switching system of FIG. 1 to allow a clear data channel to be established between two video phones while a voice grade channel is still active. FIG. 3 is partitioned into a set of discrete events indicating either actions initiated by a specific component or triggered reaction to a preceding event. In event 1-1, for example, a communication path using a voice grade channel is established between two video phone users. In event 2-0, activation of the video button in one of the video phones initiates the audio and video call. In event 2-1, a call setup message is transmitted by the video phone to the ISDN switch (switch 110 or 120 of FIG. 1) serving the caller. In event 2-2, the switch returns a call processing message to the video phone initiating the call. The call processing message indicates to that video phone that the call setup message has been forwarded to signaling network 151. In event 2-3, the call setup message

is mapped into an Initial Address Message (IAM) by the switch. The IAM message is transmitted via signaling network 151 and STP 113 or 133 of FIG. 1 to the terminating switch. In event 2-4, the terminating switch maps back the IAM message into a call setup message that is transmitted to the receiving video phone. In event 3-1, the receiving video phone transmits a "connect" message to the ISDN switch to which it is connected. In event 3-2, the terminating switch returns a message to the video phone acknowledging the reception of the "connect" message. The terminating switch in event 3-3 maps the "connect" message into an equivalent SS7 message that is transmitted via signaling network 151 of FIG. 1 and STP 133 or 113 to the originating switch (110 or 120 of FIG. 1). In event 34, the originating switch maps back the received SS7 message into a connect message that is transmitted via the signaling channel of the digital loop (104, for example) to the video phone which initiated the video call. Upon receiving the connect message, the initiating video phone uses call processing unit 213 of FIG. 2 to generate and transmit, in event 4-1 frame alignment signals to the other video phone. Similarly, the receiving video phone, upon receiving the connect acknowledgement message, in event 5-1 inserts and transmits H.221 frame alignment signals to the initiating video phone. The latter, upon detecting the frame alignment signals, in event 6-1, uses call processing unit 213 of FIG. 2 to transmit to the video phone which initiated the video call a) a synchronization indication bit, b) a signal indicating that the mode for audio signals has been set, for example to 16 Kbps and the mode for video signals has been set to 48 Kbps, and c) sixteen kilobits-coded audio signals that are inserted in H.221 frames. In event 7-1, similar information is transmitted by the receiving video phone upon detection of the H. 221 frame alignment signals. In event 8-1, the handshake is completed for the clear data communication path and the audio signals are then switched from the voice grade channel to the clear data channel over which the video signals are also being transmitted. Subsequently, the voice grade connection is torn down. If the video phones are equipped for enhanced video, the video call is transitioned from a one-bearer channel call (64 kilobits per second) to a two-bearer channel (128 Kilobits per second) using the techniques of the prior art.

[0026] The process contemplated by this invention, and illustrated in flow diagram form in FIG. 4, is initiated in step 401, when a caller at video phone 103 of FIG. 1, for example, initiates a voice grade call to video phone 123. In step 402, the call is routed over voice grade facilities (111, 116, 121) and completed. In step 403, calling and called parties agree to use audio and video media for the existing call. In step 404, a determination is made as to who (calling or called party) is going to initiate the video call by depressing the video button of video phone 103 or 123. If the calling party initiates the video call, in step 405, video phone 103 automatically redials the called party telephone number (stored in EEPROM

215 of FIG. 2) and transmits the dialed number along with a call setup message to switch 110 via the signaling channel of digital loop 104. If the called party initiates the call, video phone 123, in step 406, dials the last received number (also stored in EEPROM 215) which is transmitted along with a call setup message to switch 120 via the signaling channel of digital loop 123. In step 407, a "call processing" message is returned to the video phone initiating the video call to indicate that the call is being set up. It is to be understood that while signaling messages and handshake protocol information are being exchanged between video phones 103 and 123 using the capabilities of a) switches 110 and 120, b) signaling network 151, and c) STPs 113 and 133, the calling and called parties continue their audio conversations unaffected by the call setup activities. In step 408, video phone 123 answers the call by returning a connect message to video phone 103. Video phones 103 and 123 exchange synchronization and handshake protocol signals, as described in FIG. 3. In step 409, video phones 103 and 123 generate and transmit to each other via the clear data channel (a channel in trunk groups 112, 117 and 119 of FIG. 1) digital signals that can be decoded by audio codec 207 of FIG. 2. In step 410, the signals received by the codec in each of the video phone are decoded. Thereafter, in step 411, the source of audio signals to the users is switched from the voice grade channel to the clear data channel. In step 412, the voice grade channel is torn down.

[0027] The above description is to be construed only as an illustrative embodiment of this invention. Persons skilled in the art can easily conceive of alternative arrangements providing similar functionality without any deviation from the fundamental principles or the scope of this invention.

Claims

1. A method of converting a voice grade audio call between two parties having ISDN video phones (103, 107, 123, 127) in a communication switching system arranged to route POTS traffic and ISDN traffic to an ISDN audio and video call connecting said ISDN video phones, each one served by an ISDN subscriber loop having a first logical bearer channel (201), a second logical bearer channel (230) and a logical signaling channel (235), the method including the steps of:

setting up (403-406) said ISDN audio and video call while maintaining said voice grade call occupying said first logical bearer channel; transmitting (407) call setup messages via said signaling channel of said ISDN subscriber loop; exchanging (408) synchronization signals between said video phones via said second logical bearer channel of said video phone;

switching (411) audio signals from said first logical bearer channel to said second logical bearer channel for said ISDN audio and video call, whereby a graceful transition from the voice grade audio call to the ISDN audio and video call is achieved; and
 tearing down (412) said voice grade call.

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2. A method as claimed in claim 1, wherein said synchronization signals include information to allocate bandwidth for the audio and video signals of said ISDN audio and video call.

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3. A method as claimed in claim 1, wherein said setting up step of said ISDN audio and video call includes the step of activating in one of said video phones a mechanism that is linked to a processor included in said video phones having a memory arranged to store i) received telephone numbers of incoming calls, and ii) dialed telephone numbers of outgoing calls.

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4. A method as claimed in claim 3, wherein said activating step includes the steps of:

retrieving from said memory the last received telephone number stored in said memory when said voice grade call was received by said video phone; and
 dialing said retrieved number.

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5. A method as claimed in claim 3, wherein said activating of said mechanism step includes the steps of

retrieving from said memory the last dialed telephone number stored in said memory when said voice grade call was initiated by said video phone; and
 dialing said retrieved number.

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6. A system of converting a voice grade audio call between two parties having ISDN video phones (103, 107, 123, 127) in a communication switching system arranged to route POTS traffic and ISDN traffic to an ISDN audio and video call connecting said ISDN video phones, each one served by an ISDN subscriber loop having a first logical bearer channel (201), a second logical bearer channel (230) and a logical signaling channel (235), comprising:

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means for setting up said ISDN audio and video call while maintaining said voice grade call occupying said first logical bearer channel;
 means for transmitting call setup messages via said signaling channel of said ISDN subscriber loop;
 means for exchanging synchronization signals between said video phones via said second

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logical bearer channel of said video phone;
 means for switching audio signals from said first logical bearer channel to said second logical bearer channel for said ISDN audio and video call, whereby a graceful transition from the voice grade audio call to the ISDN audio and video call is achieved; and
 means for tearing down said voice grade call.

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7. A system as claimed in claim 6, wherein said synchronization signals include information to allocate bandwidth for the audio and video signals of said ISDN audio and video call.

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8. A system as claimed in claim 6, wherein said setting up means of said ISDN audio and video call includes means for activating in one of said video phones a mechanism that is linked to a processor included in said video phones having a memory arranged to store i) telephone numbers received for incoming calls, and ii) telephone numbers dialed for outgoing calls;

9. A system as claimed in claim 8, wherein said activating means includes:

means for retrieving from said memory the last received telephone number stored in said memory when said voice grade call was received by said video phone; and
 means for dialing said retrieved number.

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10. A system as claimed in claim 8, wherein said means for activating of said mechanism includes:

means for retrieving from said memory the last dialed telephone number stored in said memory when said voice grade call was initiated by said video phone; and
 means for dialing said retrieved number.

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11. Apparatus for use in an ISDN video phone (103, 107, 123, 127) for converting a voice grade audio call to an ISDN multimedia call, said video phone being connected to an ISDN subscriber loop including two logical bearer channels (201, 230) and a signaling channel (235), including:

a processor (213) which generates, transmits and receives a) call set up messages to initiate said multimedia call, and b) handshake protocol and synchronization signals to establish a communication path over a logical bearer channel (230) different from the logical channel (201) being used by said voice grade call;
 means (215) included in said processor for storing telephone numbers dialed for an outgoing calls and telephone numbers received for in-

coming calls;
means (251) for triggering said processor to initiate said multimedia call by generating said call setup messages including one of either the last stored dialed telephone number or the last stored received number; and
a matrix switch (203) controlled by said processor which switches incoming and outgoing audio signals from said logical channel used for said voice grade call to said communication path.

Patentansprüche

- Verfahren zum Umsetzen einer Sprech-Audioverbindung zwischen zwei Teilnehmern mit ISDN-Video-Fernsprechern (103, 107, 123, 127) in einem Kommunikationsvermittlungssystem, das zum Lenken von POTS-Verkehr und ISDN-Verkehr ausgelegt ist in eine die ISDN-Video-Fernsprecher verbindende ISDN-Audio- und -Videoverbindung, wobei beide von einer ISDN-Teilnehmerschleife versorgt werden, die einen ersten logischen Trägerkanal (201), einen zweiten logischen Trägerkanal (230) und einen logischen Zeichengabekanal (235) aufweist, mit den folgenden Schritten:

Aufbauen (403-406) der ISDN-Audio- und -Videoverbindung unter Aufrechterhaltung der Sprechverbindung, die den ersten logischen Trägerkanal einnimmt;
Übertragen (407) von Verbindungsaufbaunachrichten über den Zeichengabekanal der ISDN-Teilnehmerschleife;
Austauschen (408) von Synchronisierungssignalen zwischen den Video-Fernsprechern über den zweiten logischen Trägerkanal des Video-Fernsprechers;
Vermitteln (411) von Audiosignalen von dem ersten logischen Trägerkanal zu dem zweiten logischen Trägerkanal für die ISDN-Audio- und -Videoverbindung, wodurch ein geschmeidiger Übergang von der Sprech-Audioverbindung zu der ISDN-Audio- und -Videoverbindung erzielt wird; und
Abbauen (412) der Sprechverbindung.

- Verfahren nach Anspruch 1, wobei die Synchronisierungssignale Informationen zum Zuteilen von Bandbreite für die Audio- und Videosignale der ISDN-Audio- und -Videoverbindung enthalten.
- Verfahren nach Anspruch 1, wobei bei dem Schritt des Aufbaus der ISDN-Audio- und -Videoverbindung in einem der Video-Fernsprecher ein Mechanismus aktiviert wird, der mit einem in den Video-Fernsprechern enthaltenen Prozessor verbunden

ist, der einen Speicher aufweist, der so ausgelegt ist, daß er

- i) empfangene Rufnummern ankommender Verbindungen und
- ii) gewählte Rufnummern abgehender Verbindungen speichert.

- Verfahren nach Anspruch 3, wobei das Aktivieren die folgenden Schritte umfaßt:

Abrufen der letzten empfangenen Rufnummer aus dem Speicher, die in dem Speicher gespeichert wurde, als die Sprechverbindung von dem Video-Fernsprecher empfangen wurde; und
Wählen der abgerufenen Nummer.

- Verfahren nach Anspruch 3, wobei das Aktivieren des Mechanismus die folgenden Schritte umfaßt:

Abrufen der letzten gewählten Rufnummer aus dem Speicher, die in dem Speicher gespeichert wurde, als die Sprechverbindung von dem Video-Fernsprecher eingeleitet wurde; und
Wählen der abgerufenen Nummer.

- System zum Umsetzen einer Sprech-Audioverbindung zwischen zwei Teilnehmern mit ISDN-Video-Fernsprechern (103, 107, 123, 127) in einem Kommunikationsvermittlungssystem, das zum Lenken von POTS-Verkehr und ISDN-Verkehr ausgelegt ist, in eine die ISDN-Video-Fernsprecher verbindende ISDN-Audio- und -Videoverbindung wobei beide von einer ISDN-Teilnehmerschleife versorgt werden, die einen ersten logischen Trägerkanal (201), einen zweiten logischen Trägerkanal (230) und einen logischen Zeichengabekanal (235) aufweist, umfassend:

ein Mittel zum Aufbauen der ISDN-Audio- und -Videoverbindung unter Aufrechterhaltung der Sprechverbindung, die den ersten logischen Trägerkanal einnimmt;
ein Mittel zum Übertragen von Verbindungsaufbaunachrichten über den Zeichengabekanal der ISDN-Teilnehmerschleife;
ein Mittel zum Austauschen von Synchronisierungssignalen zwischen den Video-Fernsprechern über den zweiten logischen Trägerkanal des Video-Fernsprechers;
ein Mittel zum Vermitteln von Audiosignalen von dem ersten logischen Trägerkanal zu dem zweiten logischen Trägerkanal für die ISDN-Audio- und -Videoverbindung, wodurch ein geschmeidiger Übergang von der Sprech-Audioverbindung zu der ISDN-Audio- und -Videoverbindung erzielt wird; und

ein Mittel zum Abbauen der Sprechverbindung.

7. System nach Anspruch 6, wobei die Synchronisierungssignale Informationen zum Zuteilen von Bandbreite für die Audio- und Videosignale der ISDN-Audio- und -Videoverbindung enthalten. 5

8. System nach Anspruch 6, wobei das Mittel zum Aufbauen der ISDN-Audio- und -Videoverbindung ein Mittel enthält, das in einem der Video-Fernsprecher einen Mechanismus aktiviert, der mit einem in den Video-Fernsprechern enthaltenen Prozessor verbunden ist, der einen Speicher aufweist, der so ausgelegt ist, daß er i) für ankommende Verbindungen empfangene Rufnummern und ii) für abgehende Verbindungen gewählte Rufnummern speichert. 10 15

9. System nach Anspruch 8, wobei das Aktivierungsmitte folgendes enthält:

ein Mittel zum Abrufen der letzten empfangenen Rufnummer aus dem Speicher, die in dem Speicher gespeichert wurde, als die Sprechverbindung von dem Video-Fernsprecher empfangen wurde; und 25

ein Mittel zum Wählen der abgerufenen Nummer.

10. System nach Anspruch 8, wobei das Mittel, das den Mechanismus aktiviert, folgendes enthält: 30

ein Mittel zum Abrufen der letzten gewählten Rufnummer aus dem Speicher, die in dem Speicher gespeichert wurde, als die Sprechverbindung von dem Video-Fernsprecher eingeleitet wurde; und 35

ein Mittel zum Wählen der abgerufenen Nummer.

11. Vorrichtung zur Verwendung in einem ISDN-Video-Fernsprecher (103, 107, 123, 127) zum Umsetzen einer Sprech-Audioverbindung in eine ISDN-Multimedieverbindung, wobei der Video-Fernsprecher mit einer ISDN-Teilnehmerschleife verbunden ist, die zwei logische Trägerkanäle (201, 230) und einen Zeichengabekanal (235) aufweist, umfassend: 40 45

einen Prozessor (213), der folgendes erzeugt, sendet und empfängt: a) Verbindungsaufrünnachrichten zur Einleitung der Multimedieverbindung und b) Quittungsprotokoll- und Synchronisierungssignale zur Herstellung eines Kommunikationswegs über einen logischen Trägerkanal (230), der von dem logischen Kanal (201), der von der Sprechverbindung verwendet wird, verschieden ist;

ein Mittel (215) in dem Prozessor zum Speichern von Rufnummern, die für abgehende 50 55

Verbindungen gewählt werden, und Rufnummern, die für ankommende Verbindungen empfangen werden;

ein Mittel (251), das den Prozessor veranlaßt, die Multimedieverbindung einzuleiten, indem die Verbindungsaufrünnachrichten, die entweder die letzte gespeicherte gewählte Rufnummer oder die letzte gespeicherte empfangene Rufnummer enthalten, erzeugt werden; und ein durch den Prozessor gesteuertes Koppelfeld (203), das ankommende und abgehende Audiosignale aus dem für die Sprechverbindung verwendeten logischen Kanal zu dem Kommunikationsweg vermittelt.

Revendications

- Procédé de conversion d'un appel audio de qualité vocale entre deux correspondants possédant des visiophones RNIS (103, 107, 123, 127) dans un système de commutation de communication conçu pour acheminer du trafic RTC et du trafic RNIS vers un appel audio et vidéo RNIS connectant lesdits visiophones RNIS, chacun étant desservi par une ligne d'abonné RNIS dotée d'une première voie porteuse logique (201), d'une deuxième voie porteuse logique (230) et d'une voie de signalisation logique (235), le procédé comportant les étapes de :
 établissement (403-406) dudit appel audio et vidéo RNIS tout en maintenant l'occupation par ledit appel de qualité vocale de ladite première voie porteuse logique ;
 transmission (407) de messages d'établissement d'appel via ladite voie de signalisation de ladite ligne d'abonné RNIS ;
 échange (408) de signaux de synchronisation entre lesdits visiophones via ladite deuxième voie porteuse logique dudit visiophone ;
 commutation (411) de signaux audio de ladite première voie porteuse logique à ladite deuxième voie porteuse logique pour ledit appel audio et vidéo RNIS, de façon à obtenir une transition en douceur entre l'appel audio de qualité vocale et l'appel audio et vidéo RNIS ; et
 coupure (412) dudit appel de qualité vocale.
- Procédé selon la revendication 1, dans lequel lesdits signaux de synchronisation comportent des informations servant à l'allocation d'une bande passante pour les signaux audio et vidéo dudit appel audio et vidéo RNIS.
- Procédé selon la revendication 1, dans lequel ladite étape d'établissement dudit appel audio et vidéo RNIS comporte l'étape d'activation dans un desdits visiophones d'un mécanisme lié à un processeur in-

clus dans lesdits visiophones doté d'une mémoire conçue pour stocker i) des numéros de téléphone reçus d'appels d'arrivée, et ii) des numéros de téléphone composés d'appels de départ.

4. Procédé selon la revendication 3, dans lequel ladite étape d'activation comporte les étapes de :

extraction de ladite mémoire du dernier numéro de téléphone reçu stocké dans ladite mémoire lorsque ledit appel de qualité vocale a été reçu par ledit visiophone ; et
composition dudit numéro extrait.

5. Procédé selon la revendication 3, dans lequel ladite étape d'activation dudit mécanisme comporte les étapes de :

extraction de ladite mémoire du dernier numéro de téléphone composé stocké dans ladite mémoire lorsque ledit appel de qualité vocale a été lancé par ledit visiophone ; et
composition dudit numéro extrait.

6. Système de conversion d'un appel audio de qualité vocale entre deux correspondants possédant des visiophones RNIS (103, 107, 123, 127) dans un système de commutation de communication conçu pour acheminer du trafic RTC et du trafic RNIS vers un appel audio et vidéo RNIS connectant lesdits visiophones RNIS, chacun étant desservi par une ligne d'abonné RNIS dotée d'une première voie porteuse logique (201), d'une deuxième voie porteuse logique (230) et d'une voie de signalisation logique (235), comprenant :

un moyen d'établissement dudit appel audio et vidéo RNIS tout en maintenant l'occupation par ledit appel de qualité vocale de ladite première voie porteuse logique ;
un moyen de transmission de messages d'établissement d'appel via ladite voie de signalisation de ladite ligne d'abonné RNIS ;
un moyen d'échange de signaux de synchronisation entre lesdits visiophones via ladite deuxième voie porteuse logique dudit visiophone ;
un moyen de commutation de signaux audio de ladite première voie porteuse logique à ladite deuxième voie porteuse logique pour ledit appel audio et vidéo RNIS, de façon à obtenir une transition en douceur entre l'appel audio de qualité vocale et l'appel audio et vidéo RNIS ; et
un moyen de coupure dudit appel de qualité vocale.

7. Système selon la revendication 6, dans lequel lesdits signaux de synchronisation comportent des in-

formations servant à l'allocation d'une bande passante pour les signaux audio et vidéo dudit appel audio et vidéo RNIS.

5 8. Système selon la revendication 6, dans lequel ledit moyen d'établissement dudit appel audio et vidéo RNIS comporte un moyen d'activation dans un desdits visiophones d'un mécanisme lié à un processeur inclus dans lesdits visiophones doté d'une mémoire conçue pour stocker i) des numéros de téléphone reçus pour des appels d'arrivée, et ii) des numéros de téléphone composés pour des appels de départ.

10 15 9. Système selon la revendication 8, dans lequel ledit moyen d'activation comporte :

un moyen d'extraction de ladite mémoire du dernier numéro de téléphone reçu stocké dans ladite mémoire lorsque ledit appel de qualité vocale a été reçu par ledit visiophone ; et
un moyen de composition dudit numéro extrait.

10. Système selon la revendication 8, dans lequel ledit moyen d'activation dudit mécanisme comporte :

un moyen d'extraction de ladite mémoire du dernier numéro de téléphone composé stocké dans ladite mémoire lorsque ledit appel de qualité vocale a été lancé par ledit visiophone ; et
un moyen de composition dudit numéro extrait.

15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 145 150 155 160 165 170 175 180 185 190 195 200 205 210 215 220 225 230 235 240 245 250 255 260 265 270 275 280 285 290 295 300 305 310 315 320 325 330 335 340 345 350 355 360 365 370 375 380 385 390 395 400 405 410 415 420 425 430 435 440 445 450 455 460 465 470 475 480 485 490 495 500 505 510 515 520 525 530 535 540 545 550 555 560 565 570 575 580 585 590 595 600 605 610 615 620 625 630 635 640 645 650 655 660 665 670 675 680 685 690 695 700 705 710 715 720 725 730 735 740 745 750 755 760 765 770 775 780 785 790 795 800 805 810 815 820 825 830 835 840 845 850 855 860 865 870 875 880 885 890 895 900 905 910 915 920 925 930 935 940 945 950 955 960 965 970 975 980 985 990 995 1000 1005 1010 1015 1020 1025 1030 1035 1040 1045 1050 1055 1060 1065 1070 1075 1080 1085 1090 1095 1100 1105 1110 1115 1120 1125 1130 1135 1140 1145 1150 1155 1160 1165 1170 1175 1180 1185 1190 1195 1200 1205 1210 1215 1220 1225 1230 1235 1240 1245 1250 1255 1260 1265 1270 1275 1280 1285 1290 1295 1300 1305 1310 1315 1320 1325 1330 1335 1340 1345 1350 1355 1360 1365 1370 1375 1380 1385 1390 1395 1400 1405 1410 1415 1420 1425 1430 1435 1440 1445 1450 1455 1460 1465 1470 1475 1480 1485 1490 1495 1500 1505 1510 1515 1520 1525 1530 1535 1540 1545 1550 1555 1560 1565 1570 1575 1580 1585 1590 1595 1600 1605 1610 1615 1620 1625 1630 1635 1640 1645 1650 1655 1660 1665 1670 1675 1680 1685 1690 1695 1700 1705 1710 1715 1720 1725 1730 1735 1740 1745 1750 1755 1760 1765 1770 1775 1780 1785 1790 1795 1800 1805 1810 1815 1820 1825 1830 1835 1840 1845 1850 1855 1860 1865 1870 1875 1880 1885 1890 1895 1900 1905 1910 1915 1920 1925 1930 1935 1940 1945 1950 1955 1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055 2060 2065 2070 2075 2080 2085 2090 2095 2100 2105 2110 2115 2120 2125 2130 2135 2140 2145 2150 2155 2160 2165 2170 2175 2180 2185 2190 2195 2200 2205 2210 2215 2220 2225 2230 2235 2240 2245 2250 2255 2260 2265 2270 2275 2280 2285 2290 2295 2300 2305 2310 2315 2320 2325 2330 2335 2340 2345 2350 2355 2360 2365 2370 2375 2380 2385 2390 2395 2400 2405 2410 2415 2420 2425 2430 2435 2440 2445 2450 2455 2460 2465 2470 2475 2480 2485 2490 2495 2500 2505 2510 2515 2520 2525 2530 2535 2540 2545 2550 2555 2560 2565 2570 2575 2580 2585 2590 2595 2600 2605 2610 2615 2620 2625 2630 2635 2640 2645 2650 2655 2660 2665 2670 2675 2680 2685 2690 2695 2700 2705 2710 2715 2720 2725 2730 2735 2740 2745 2750 2755 2760 2765 2770 2775 2780 2785 2790 2795 2800 2805 2810 2815 2820 2825 2830 2835 2840 2845 2850 2855 2860 2865 2870 2875 2880 2885 2890 2895 2900 2905 2910 2915 2920 2925 2930 2935 2940 2945 2950 2955 2960 2965 2970 2975 2980 2985 2990 2995 3000 3005 3010 3015 3020 3025 3030 3035 3040 3045 3050 3055 3060 3065 3070 3075 3080 3085 3090 3095 3100 3105 3110 3115 3120 3125 3130 3135 3140 3145 3150 3155 3160 3165 3170 3175 3180 3185 3190 3195 3200 3205 3210 3215 3220 3225 3230 3235 3240 3245 3250 3255 3260 3265 3270 3275 3280 3285 3290 3295 3300 3305 3310 3315 3320 3325 3330 3335 3340 3345 3350 3355 3360 3365 3370 3375 3380 3385 3390 3395 3400 3405 3410 3415 3420 3425 3430 3435 3440 3445 3450 3455 3460 3465 3470 3475 3480 3485 3490 3495 3500 3505 3510 3515 3520 3525 3530 3535 3540 3545 3550 3555 3560 3565 3570 3575 3580 3585 3590 3595 3600 3605 3610 3615 3620 3625 3630 3635 3640 3645 3650 3655 3660 3665 3670 3675 3680 3685 3690 3695 3700 3705 3710 3715 3720 3725 3730 3735 3740 3745 3750 3755 3760 3765 3770 3775 3780 3785 3790 3795 3800 3805 3810 3815 3820 3825 3830 3835 3840 3845 3850 3855 3860 3865 3870 3875 3880 3885 3890 3895 3900 3905 3910 3915 3920 3925 3930 3935 3940 3945 3950 3955 3960 3965 3970 3975 3980 3985 3990 3995 4000 4005 4010 4015 4020 4025 4030 4035 4040 4045 4050 4055 4060 4065 4070 4075 4080 4085 4090 4095 4100 4105 4110 4115 4120 4125 4130 4135 4140 4145 4150 4155 4160 4165 4170 4175 4180 4185 4190 4195 4200 4205 4210 4215 4220 4225 4230 4235 4240 4245 4250 4255 4260 4265 4270 4275 4280 4285 4290 4295 4300 4305 4310 4315 4320 4325 4330 4335 4340 4345 4350 4355 4360 4365 4370 4375 4380 4385 4390 4395 4400 4405 4410 4415 4420 4425 4430 4435 4440 4445 4450 4455 4460 4465 4470 4475 4480 4485 4490 4495 4500 4505 4510 4515 4520 4525 4530 4535 4540 4545 4550 4555 4560 4565 4570 4575 4580 4585 4590 4595 4600 4605 4610 4615 4620 4625 4630 4635 4640 4645 4650 4655 4660 4665 4670 4675 4680 4685 4690 4695 4700 4705 4710 4715 4720 4725 4730 4735 4740 4745 4750 4755 4760 4765 4770 4775 4780 4785 4790 4795 4800 4805 4810 4815 4820 4825 4830 4835 4840 4845 4850 4855 4860 4865 4870 4875 4880 4885 4890 4895 4900 4905 4910 4915 4920 4925 4930 4935 4940 4945 4950 4955 4960 4965 4970 4975 4980 4985 4990 4995 5000 5005 5010 5015 5020 5025 5030 5035 5040 5045 5050 5055 5060 5065 5070 5075 5080 5085 5090 5095 5100 5105 5110 5115 5120 5125 5130 5135 5140 5145 5150 5155 5160 5165 5170 5175 5180 5185 5190 5195 5200 5205 5210 5215 5220 5225 5230 5235 5240 5245 5250 5255 5260 5265 5270 5275 5280 5285 5290 5295 5300 5305 5310 5315 5320 5325 5330 5335 5340 5345 5350 5355 5360 5365 5370 5375 5380 5385 5390 5395 5400 5405 5410 5415 5420 5425 5430 5435 5440 5445 5450 5455 5460 5465 5470 5475 5480 5485 5490 5495 5500 5505 5510 5515 5520 5525 5530 5535 5540 5545 5550 5555 5560 5565 5570 5575 5580 5585 5590 5595 5600 5605 5610 5615 5620 5625 5630 5635 5640 5645 5650 5655 5660 5665 5670 5675 5680 5685 5690 5695 5700 5705 5710 5715 5720 5725 5730 5735 5740 5745 5750 5755 5760 5765 5770 5775 5780 5785 5790 5795 5800 5805 5810 5815 5820 5825 5830 5835 5840 5845 5850 5855 5860 5865 5870 5875 5880 5885 5890 5895 5900 5905 5910 5915 5920 5925 5930 5935 5940 5945 5950 5955 5960 5965 5970 5975 5980 5985 5990 5995 6000 6005 6010 6015 6020 6025 6030 6035 6040 6045 6050 6055 6060 6065 6070 6075 6080 6085 6090 6095 6100 6105 6110 6115 6120 6125 6130 6135 6140 6145 6150 6155 6160 6165 6170 6175 6180 6185 6190 6195 6200 6205 6210 6215 6220 6225 6230 6235 6240 6245 6250 6255 6260 6265 6270 6275 6280 6285 6290 6295 6300 6305 6310 6315 6320 6325 6330 6335 6340 6345 6350 6355 6360 6365 6370 6375 6380 6385 6390 6395 6400 6405 6410 6415 6420 6425 6430 6435 6440 6445 6450 6455 6460 6465 6470 6475 6480 6485 6490 6495 6500 6505 6510 6515 6520 6525 6530 6535 6540 6545 6550 6555 6560 6565 6570 6575 6580 6585 6590 6595 6600 6605 6610 6615 6620 6625 6630 6635 6640 6645 6650 6655 6660 6665 6670 6675 6680 6685 6690 6695 6700 6705 6710 6715 6720 6725 6730 6735 6740 6745 6750 6755 6760 6765 6770 6775 6780 6785 6790 6795 6800 6805 6810 6815 6820 6825 6830 6835 6840 6845 6850 6855 6860 6865 6870 6875 6880 6885 6890 6895 6900 6905 6910 6915 6920 6925 6930 6935 6940 6945 6950 6955 6960 6965 6970 6975 6980 6985 6990 6995 7000 7005 7010 7015 7020 7025 7030 7035 7040 7045 7050 7055 7060 7065 7070 7075 7080 7085 7090 7095 7100 7105 7110 7115 7120 7125 7130 7135 7140 7145 7150 7155 7160 7165 7170 7175 7180 7185 7190 7195 7200 7205 7210 7215 7220 7225 7230 7235 7240 7245 7250 7255 7260 7265 7270 7275 7280 7285 7290 7295 7300 7305 7310 7315 7320 7325 7330 7335 7340 7345 7350 7355 7360 7365 7370 7375 7380 7385 7390 7395 7400 7405 7410 7415 7420 7425 7430 7435 7440 7445 7450 7455 7460 7465 7470 7475 7480 7485 7490 7495 7500 7505 7510 7515 7520 7525 7530 7535 7540 7545 7550 7555 7560 7565 7570 7575 7580 7585 7590 7595 7600 7605 7610 7615 7620 7625 7630 7635 7640 7645 7650 7655 7660 7665 7670 7675 7680 7685 7690 7695 7700 7705 7710 7715 7720 7725 7730 7735 7740 7745 7750 7755 7760 7765 7770 7775 7780 7785 7790 7795 7800 7805 7810 7815 7820 7825 7830 7835 7840 7845 7850 7855 7860 7865 7870 7875 7880 7885 7890 7895 7900 7905 7910 7915 7920 7925 7930 7935 7940 7945 7950 7955 7960 7965 7970 7975 7980 7985 7990 7995 8000 8005 8010 8015 8020 8025 8030 8035 8040 8045 8050 8055 8060 8065 8070 8075 8080 8085 8090 8095 8100 8105 8110 8115 8120 8125 8130 8135 8140 8145 8150 8155 8160 8165 8170 8175 8180 8185 8190 8195 8200 8205 8210 8215 8220 8225 8230 8235 8240 8245 8250 8255 8260 8265 8270 8275 8280 8285 8290 8295 8300 8305 8310 8315 8320 8325 8330 8335 8340 8345 8350 8355 8360 8365 8370 8375 8380 8385 8390 8395 8400 8405 8410 8415 8420 8425 8430 8435 8440 8445 8450 8455 8460 8465 8470 8475 8480 8485 8490 8495 8500 8505 8510 8515 8520 8525 8530 8535 8540 8545 8550 8555 8560 8565 8570 8575 8580 8585 8590 8595 8600 8605 8610 8615 8620 8625 8630 8635 8640 8645 8650 8655 8660 8665 8670 8675 8680 8685 8690 8695 8700 8705 8710 8715 8720 8725 8730 8735 8740 8745 8750 8755 8760 8765 8770 8775 8780 8785 8790 8795 8800 8805 8810 8815 8820 8825 8830 8835 8840 8845 8850 8855 8860 8865 8870 8875 8880 8885 8890 8895 8900 8905 8910 8915 8920 8925 8930 8935 8940 8945 8950 8955 8960 8965 8970 8975 8980 8985 8990 8995 9000 9005 9010 9015 9020 9025 9030 9035 9040 9045 9050 9055 9060 9065 9070 9075 9080 9085 9090 9095 9100 9105 9110 9115 9120 9125 9130 9135 9140 9145 9150 9155 9160 9165 9170 9175 9180 9185 9190 9195 9200 9205 9210 9215 9220 9225 9230 9235 9240 9245 9250 9255 9260 9265 9270 9275 9280 9285 9290 9295 9300 9305 9310 9315 9320 9325 9330 9335 9340 9345 9350 9355 9360 9365 9370 9375 9380 9385 9390 9395 9400 9405 9410 9415 9420 9425 9430 9435 9440 9445 9450 9455 9460 9465 9470 9475 9480 9485 9490 9495 9500 9505 9510 9515 9520 9525 9530 9535 9540 9545 9550 9555 9560 9565 9570 9575 9580 9585 9590 9595 9600 9605 9610 9615 9620 9625 9630 9635 9640 9645 9650 9655 9660 9665 9670 9675 9680 9685 9690 9695 9700 9705 9710 9715 9720 9725 9730 9735 9740 9745 9750 9755 9760 9765 9770 9775 9780 9785 9790 9795 9800 9805 9810 9815 9820 9825 9830 9835 9840 9845 9850 9855 9860 9865 9870 9875 9880 9885 9890 9895 9900 9905 9910 9915 9920 9925 9930 9935 9940 9945 9950 9955 9960 9965 9970 9975 9980 9985 9990 9995 10000 10005 10010 10015 10020 10025 10030 10035 10040 10045 10050 10055 10060 10065 10070 10075 10080 10085 10090 10095 10100 10105 10110 10115 10120 10125 10130 10135 10140 10145 10150 10155 10160 10165 10170 10175 10180 10185 10190 10195 10200 10205 10210 10215 10220 10225 10230 10235 10240 10245 10250 10255 10260 10265 10270 10275 10280 10285 10290 10295 10300 10305 10310 10315 10320 10325 10330 10335 10340 10345 10350 10355 10360 10365 10370 10375 10380

le dernier numéro reçu stocké ; et
un commutateur matriciel (203) commandé par
ledit processeur, qui commute des signaux
audio d'arrivée et de départ de ladite voie logi-
que utilisée pour ledit appel de qualité vocale 5
sur ledit chemin de communication.

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FIG. 1

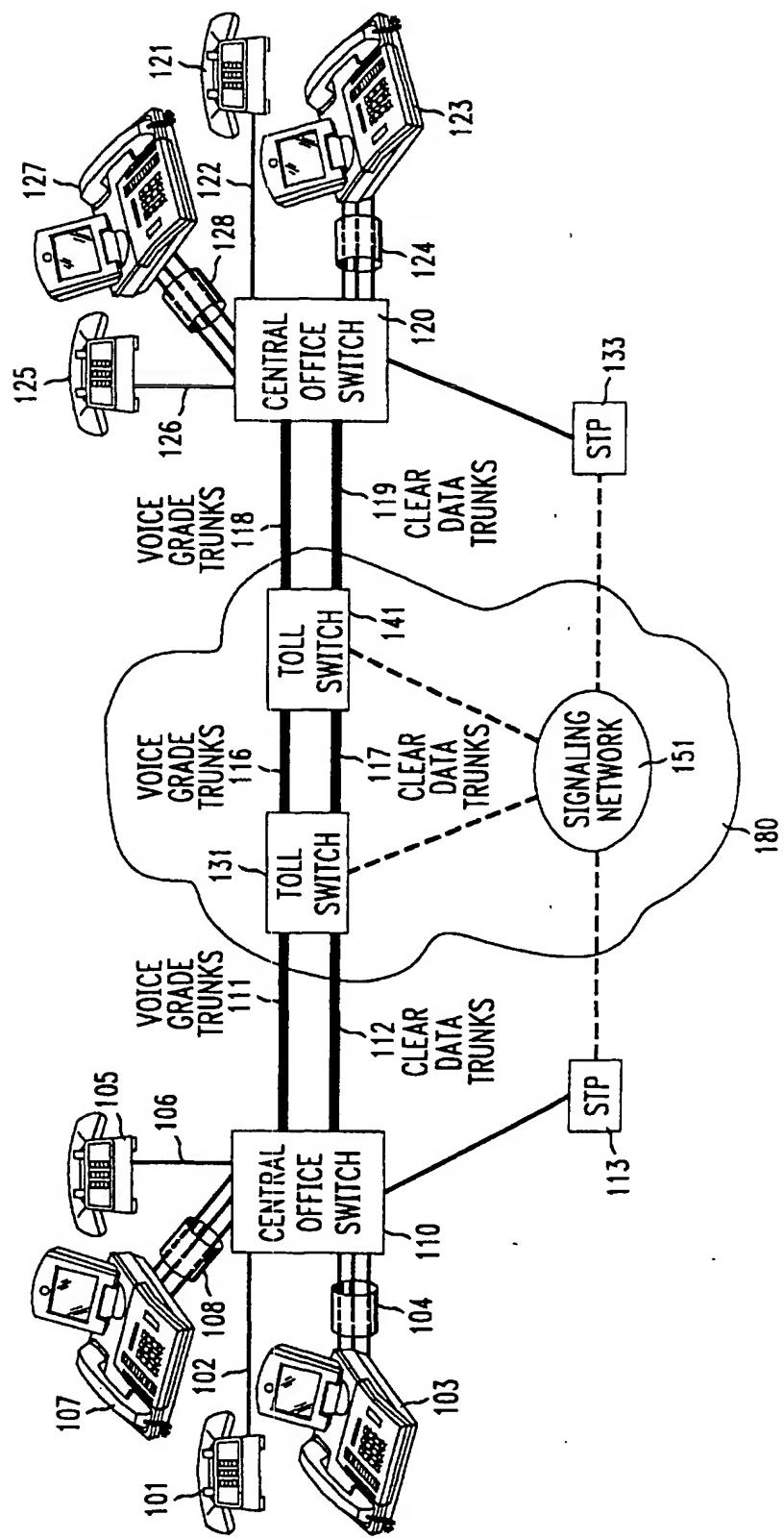


FIG. 2

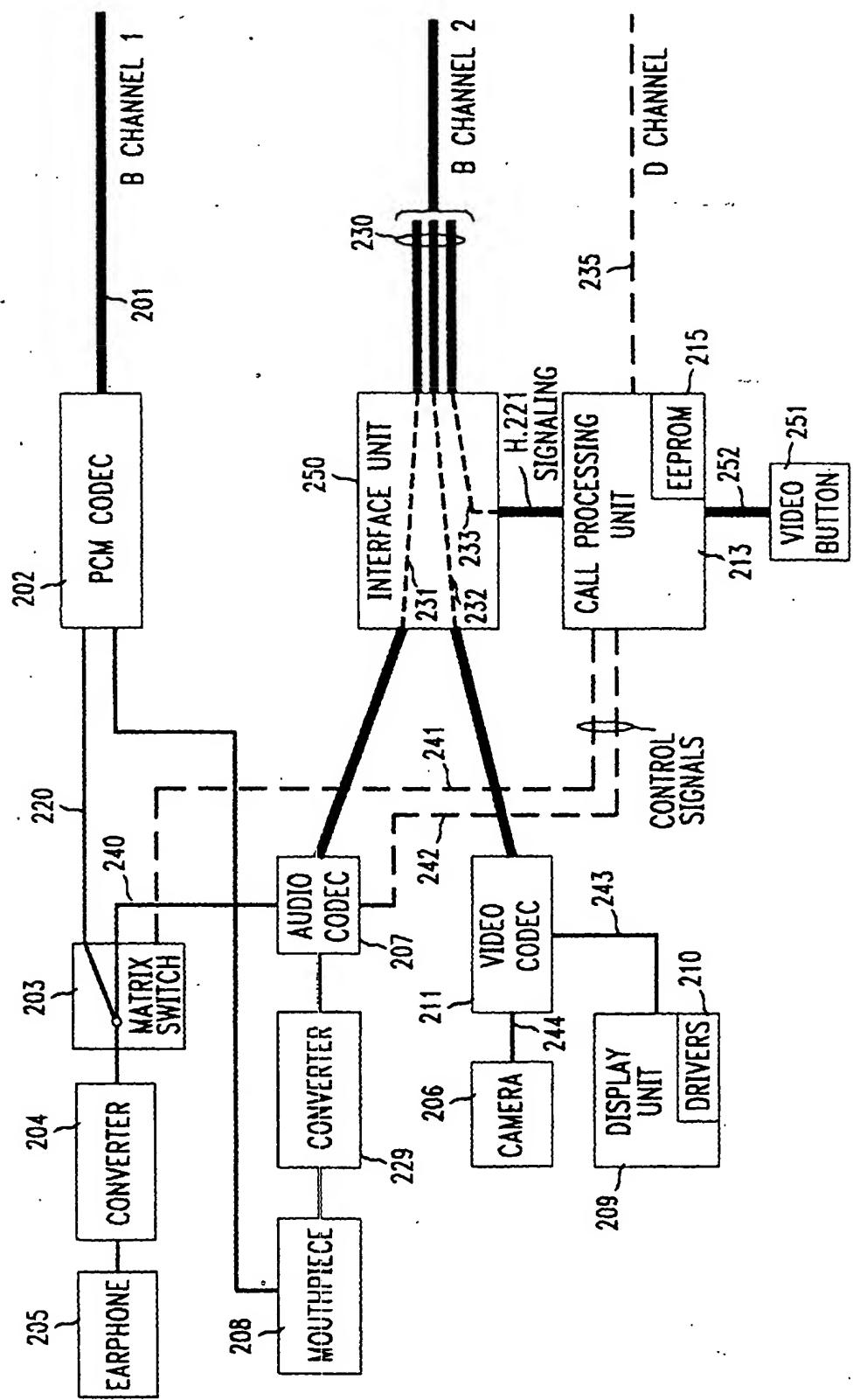


FIG. 3

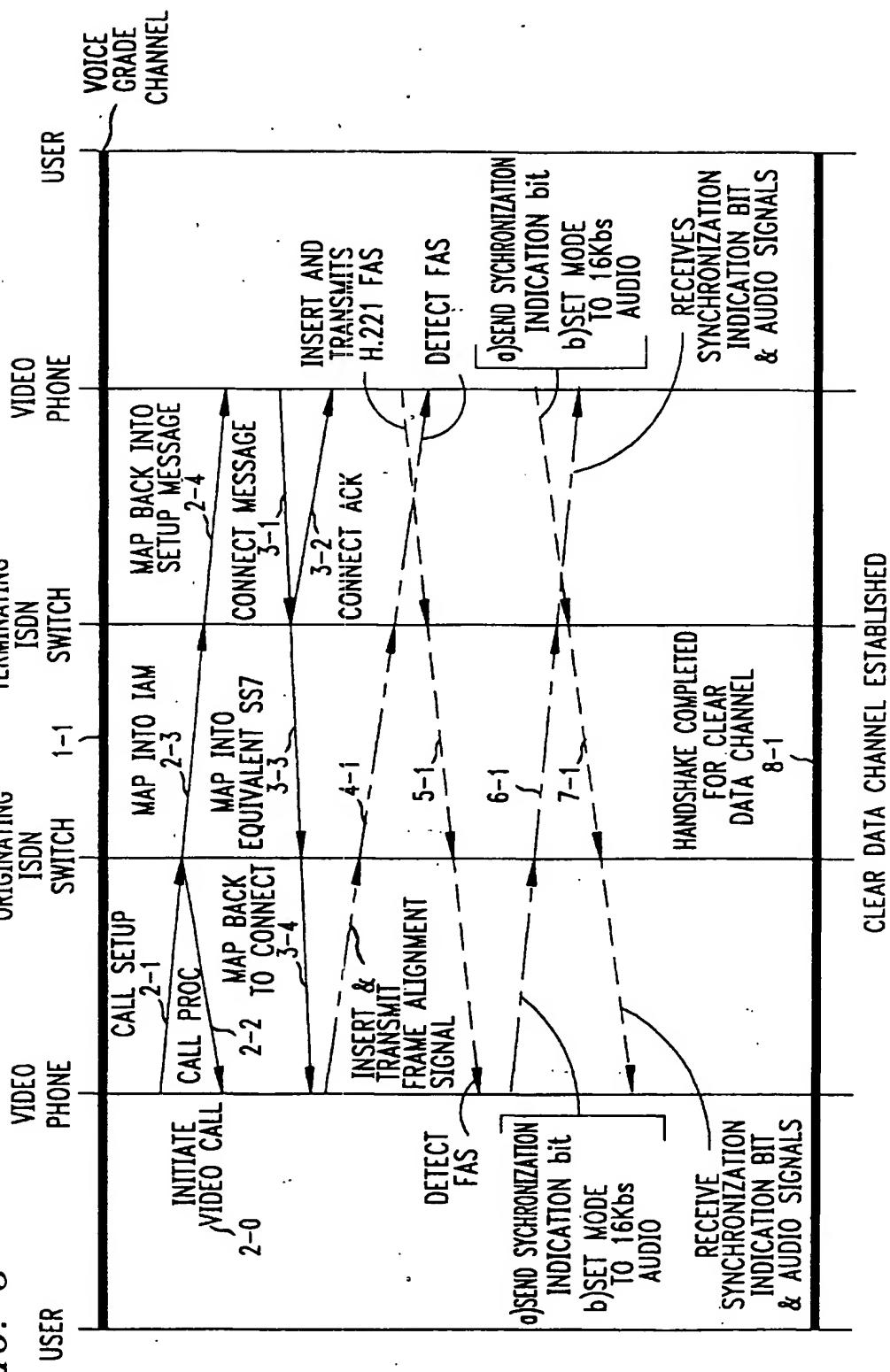


FIG. 4

